CLAIMS

1. A charged particle detector suitable for use in a focused ion beam system including a focused ion beam that can be directed to a target and that produces secondary particles upon impact of the ion beam with the target, the charged particle detector comprising:

an input screen to which voltages can be selectively applied relative to the target so as to attract positive or negative secondary charged particles emitted from the target;

an ion-to-electron converter including a material that emits electrons when impacted by charged particles from the target; and

a scintillator detector for detecting electrons originating at the target or electrons originating in the ion-to-electron converter.

2. The apparatus of claim 1 in which the ion-to-electron converter is configurable in a first configuration to convert ions emitted from a target to electrons for detection by the scintillator detector and configurable in a second configuration to pass electrons from the target through the ion-to-electron converter for detection by scintillator detector.

3. The apparatus of claim 2 in which the ion-to-electron converter is configurable in the first configuration or the second configuration solely by altering one or more voltages on components of the ion-to-electron converter.

4. The apparatus of claim 1 further comprising a voltage source for applying a first voltage to the ion-to-electron converter for attracting positively charged ions from the target and causing the positively charged ions to impact the ion-to-electron converter and generate electrons for detection by the scintillator detector and for applying a second voltage to the ion-to-electron detector for passing electrons from the target through the ion-to-electron detector to the scintillator detector.

5. The apparatus of claim 1 further comprising a voltage source for applying a first voltage to the input screen for attracting positively charged ions from the target and for applying a second voltage to the input screen for attracting positively charged ions from the target.

6. The apparatus of claim 1 in which the ion-to-electron converter comprises generally parallel plates, the major planes of the plates being approximately parallel to the direction of motion of the incoming charged particles.

7. The apparatus of claim 1 in which the ion-to-electron converter comprises a hollow, generally cylindrical structure.

8. The apparatus of claim 1 in which the ion-to-electron converter comprises aluminum or stainless steel

9. A focused ion beam system, comprising:

an ion source;

ion optics for focusing ions from the ion source into an ion beam and directing it towards a target; and

a charged particle detector in accordance with claim 1 for detecting secondary positive ions or secondary electrons emitted from the target as a result of the impact of the ion beam.

10. The apparatus of claim 9 in which the ion-to-electron converter is configurable in a first configuration to convert ions emitted from a target to electrons for detection by the electron detector and configurable in a second configuration to pass electrons from the target through the ion-to-electron converter for detection by the electron detector.

11. The apparatus of claim 9 in which the ion-to-electron converter comprises a hollow, generally cylindrical structure.

12. The apparatus of claim 9 in which the ion-to-electron converter comprises aluminum or stainless steel.

13. An ion-to-electron converter for use with an electron detector to detect ions originating from a target by causing the ions to generate electrons to be detected by the electron detector, the ion-to-electron converter comprising a material that when stuck by an ion generates electrons for detection and having a structure such that when a first voltage is applied to the ion-to-electron converter, ions are attracted to the ion-to-electron converter, collide with a surface of the ion-to-electron converter, and generate electrons that are detected by the electron detector, and when a second voltage is applied, electrons pass through the ion-to-electron converter and are detected by the electron detector.

14. The ion-to-electron converter of claim 13 in which the electron detector comprises a scintillator detector.

15. The ion-to-electron converter of claim 13 in which the ion-to-electron converter has a shape approximating a hollow cylinder.

16. The ion-to-electron converter of claim 13 in which the ion-to-electron converter comprises multiple parallel plates.

17. The ion-to-electron converter of claim 13 in which the ion-to-electron converter comprises aluminum or stainless steel.

18. A method of detecting positive or negative charged particles, comprising

selectively attracting positive ions or electrons from a target;

if positive ions are selectively attracted, converting the positive ions to electrons by causing the positive ions to impact on a surface, the impact causing the emission of electrons; and

detecting using an electron detector either the electrons emitted by the impact of the positive ions from the surface or electrons selectively attracted from the target and not impacting the surface.

19. The method of claim 18 in which converting the positive ions to electrons by causing the positive ions to impact on a surface includes causing the positive ions to impact on a generally cylindrical surface.

20. The method of claim 18 in which converting the positive ions to electrons by causing the positive ions to impact on a surface includes causing the positive ions to impact on the surfaces of multiple generally parallel plates.

21. The method of claim 18 in which converting the positive ions to electrons by causing the positive ions to impact on a surface includes causing the positive ions to impact on a surface comprising aluminum oxide or stainless steel.